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MECHANISMS OF THIN FILM GROWTH AND THE INFLUENCE OF SURFACE CHEMISTRY ON FILM GROWTH AND PROPERTIES

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13. ABSTRACT *(Maximum 200 words)*

THIS PROGRAM WAS A FUNDAMENTAL RESEARCH STUDY OF THE MECHANISMS OF THIN FILM GROWTH AND THE INFLUENCE OF SURFACE CHEMISTRY ON FILM GROWTH AND PROPERTIES. THE FILM GROWTH TECHNIQUES BEING EMPHASIZED INCLUDE PULSE LASER DEPOSITION AND MOLECULAR BEAM EPITAXY. THIS IS A BIBLIOGRAPHY OF THE PUBLICATIONS GENERATED BY THIS PROGRAM.

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Approach: Pulse laser deposition will be used to deposit SiC films on SiC substrates at various substrate temperatures and deposition rates homoepitaxial growth will be monitored in-situ with electron diffraction and ex-situ by x-ray diffraction. Stoichiometry will be adjusted through the use of an SI beam source. In nanometric processing of epitaxial materials work, a diamond micromachine apparatus will be used to pattern GaAs substrates prior to epitaxial film growth in an MBE system. Finally, epitaxial films grown by MBE will be transferred through a UHV transfer system to a multi-technique surface analysis system where surface chemistry will be defined and correlated with growth parameters, surface crystallography as determine by RHEED and subsequently correlated with electronic and optical materials properties.

The **objective** of this program is a fundamental research study of the mechanisms of thin film growth and the influence of surface chemistry on film growth and properties. Film growth techniques being emphasized, include pulse laser deposition and molecular beam epitaxy. Specific current topics include determinations of the surface and near surface chemistry and morphologies of diamond turned substrates and the properties and behavior of these substrates for thin film growth. The interface chemistries of MBE grown materials are being investigated by a variety of surface analysis techniques and are being correlated with electronic and electrooptic properties of semi-conductive epitaxial films in order to lead to improved device materials. ISS is particularly valuable because of its top atomic layer sensitivity. Fundamental properties of pulse laser deposition with particular emphasis on possibilities for epitaxial film growth of SiC for high temperature electronic applications are also under investigation, as well as optical sensors to monitor films growth. In the nanometric processing of epitaxial materials area we are investigating the surface chemistry of diamond turned substrates. Of particular interest is the use of diamond patterning to prepare substrates for thin film growth. This research, if successful, could lead to revolutionary new means for growth of quantum wires and quantum dots for a variety of electro-optic and possible magnetic materials applications.

Attached is a bibliographic listing of publications associated with this work.

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"TRIBOMATERIALS AND LASER PROCESSING FOR EXTREME ENVIRONMENTS", J.S. Zabinski, invited lecture, Ohio State University, Dept. of Mechanical Engineering, Columbus, OH, Jan 1993.

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"PULSED LASER DEPOSITION OF NIOBIUM DISELENIDE THIN FILMS", A.E. Day, S.D. Walck, and J.S. Zabinski, Presented at the Conference on Laser Ablation (COLA) - 1993, Oak ridge, TN, April, 1993.

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